



**NXD SWITCHGEAR  
INSTALLATION AND COMMISSIONING  
INSTRUCTIONS**

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## 1. SCOPE OF APPLICATION

This document provides instructions and information regarding NX switchgear installation and commissioning tools. The document is derived from the Finnish language original, which will be updated as necessary. Further documents produced in other languages will be checked against the original publication.

## 2. ENVIRONMENTAL CONDITIONS

### 2.1 Standards

In transport, storage and installation, the following national and international standards will be applied unless otherwise stated in the delivery agreements.

SFS-EN 60721-3-3:1996	Environmental category NT 3 – 4
SFS 60439-1: 2000	Low-voltage switchgear and controlgear assemblies. Requirements for type-tested and partially type-tested assemblies. Part 6, Section <b>6.3 Transport, storage and installation conditions</b> . This section is concordant with the standards mentioned below.
EN 60439-1: 1999	This standard has been approved as a European standard without changes in observance of the adjoined international standard:
IEC 60439-1: 1999	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies.

### 2.2 Local conditions

The manufacturer and the user / customer shall agree on the procedures to be followed in the event that conditions during transport, storage and installation differ from the following reference values, e.g. with regard to temperature or moisture:

- The ambient temperature must not exceed 40 °C and the average temperature over a 24-h period must not exceed 35 °C.
- The air must be clean and its relative humidity must not exceed 50% at a maximum temperature of 40 °C. Higher values for relative humidity are permissible at lower temperatures, e.g. 90% at a temperature of 20 °C. Possible temporary condensation must be taken into consideration.

Unless otherwise agreed, the temperature limits for transport and storage will range from -25 °C to + 55 °C and for short periods of no more than 24 h, max. 70 °C (environment class NT 3-4).

➡ Possible permanent defects in unused equipment resulting from exceptional transportation and storage conditions may lead to operational malfunction under standard operating conditions. The manufacturer can, if necessary, separately determine the safety limits for the aforementioned transportation and storage conditions with regard to the functioning of the equipment.

### 2.3 Condensation prevention

To avoid possible corrosion, packages must be equipped with ventilation grills and, e.g., the following condensed water-binding substances placed inside: Zerust packages; VC2-1, one per each ½ mm<sup>2</sup>.

## 2.4 Temporary storage

Film-wrapped switchgear units must be stored indoors in conditions corresponding, at minimum, to those described above. Damaged transport packages must be checked and repaired as necessary.

## 3. TOOLS

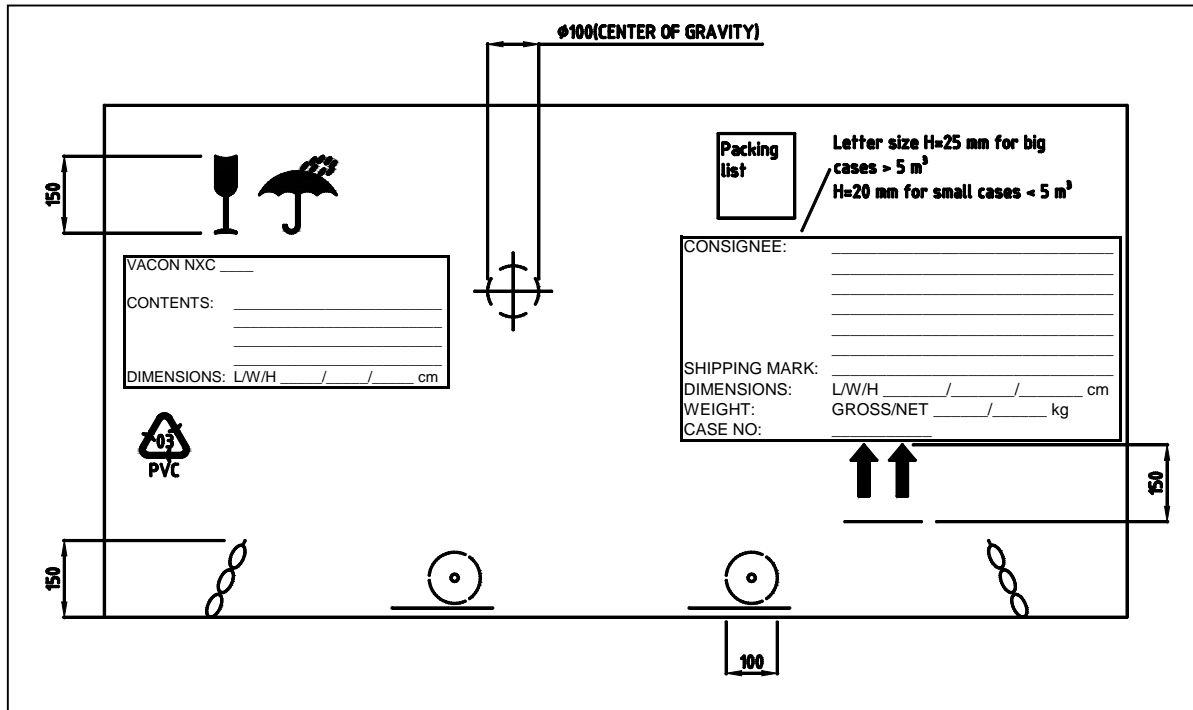
Tools and equipment needed for switchgear unit lifting, moving, installation and maintenance:

- Crowbar
- Slings (2 pieces) or lifting lugs (2 pairs)
- Screw bits:
  - TX 25 (Torx)
  - Socket no. 8
  - Washer 4 mm
  - Socket 19 mm (for M12 screws)
- Fastening to base:
  - Welding equipment
  - Stud gun
  - Stone bit (for M10 lag screws)
- Torque wrench min. 75 Nm (main circuit screw connections)
- Min. 650 mm handled fork spanner for M12 screws if the main busbar connections are accessed via the roof, phase L3, see Figure 5.3b and legend)
- Cooling equipment piping:
  - Allen key for M8 screws (width across flats 6 mm)
  - Torque wrench 15 Nm (extension joints of cooling pipes)
- Voltage tester (e.g. Megger) or insulation resistance meter
- Test transformer, if necessary

#### 4. PACKAGE HANDLING

#### 4.1 Instructions on package

Handling instructions: labelling and location on the package, see Figure 1



*Figure 1*

Delivery information, dimensions and contents, see Figure 2

VACON NXC _ _ _		Letter size H=25 mm for big cases > 5 m <sup>3</sup> H=20 mm for small cases ≤ 5 m <sup>3</sup>
CONTENTS:	..... ..... ..... ..... ..... ..... ..... .....	
DIMENSIONS:	L/W/H ...../...../..... cm	
WEIGHT:	GROSS/NET ...../..... kg	
CASE NO:	.....	

Figure 2

## 4.2 Moving and lifting

The instructions on the package must state the dimensions, weight and centre of gravity of the package. Attention must be paid to the order of movement of the packages (i.e. according to the package contents).

**Transport on site** can be carried out as follows by a forklift truck, a hoist or on rollers, see Figures 3, 4 and 5:

- Lower the package onto a level base
- Remove the package covering only at the site of installation
- Low, narrow or convoluted transport routes may require removal of the pallet prior to movement
- Move packages in the upright position only, see Figure 3.

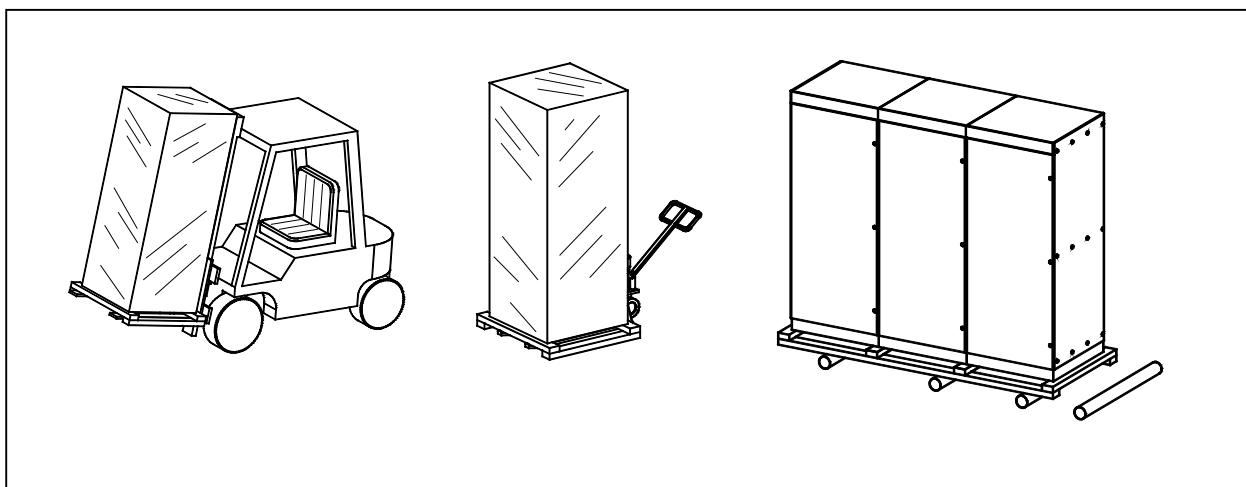


Figure 3

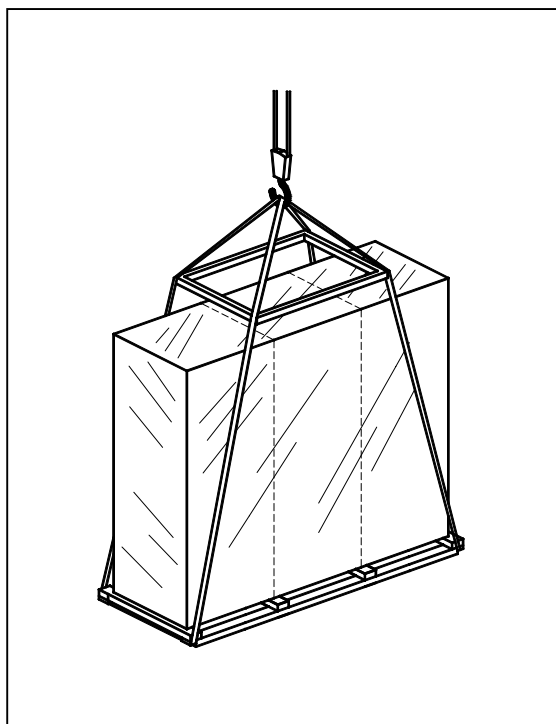


Figure 4

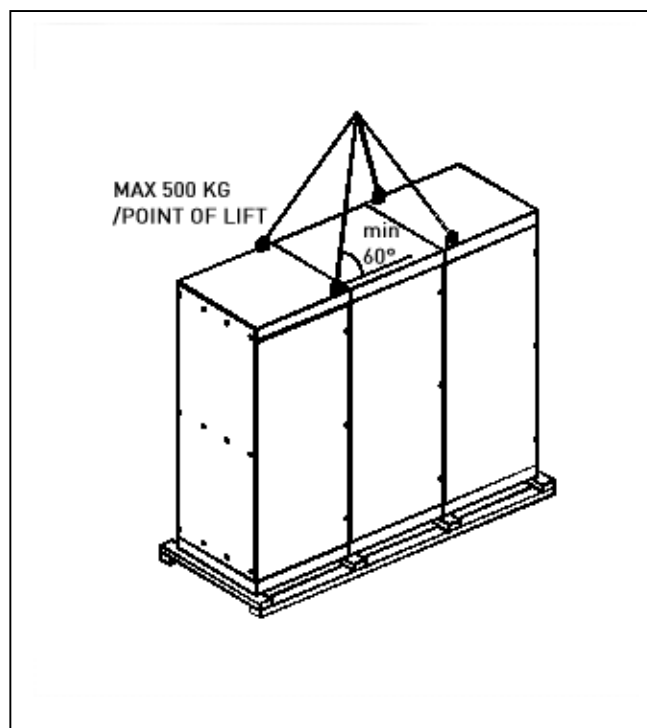


Figure 5

### 4.3 Package inspection and unpacking

After arrival of the consignment or before interim storage, the package contents must be compared with the delivery information stated on the package, see Figure 2.

Any possible transport damages must be addressed immediately:

- Record any visible damage in the observations column on the package register
- Written notification of both visible and hidden defects must be submitted to the transport company concerned within one week
- Packages awaiting transfer to interim storage must be checked if the aforementioned transport damages are suspected.

#### 4.3.1 Waste handling

All packaging materials are recyclable. Waste handling procedures are agreed on with the local customer representative as necessary.

## 5. INSTALLATION

### 5.1 Installation site inspection

The installation site is inspected with regard to any defects or shortcomings for which repair at a later stage may prove difficult or which may pose a risk of damage to installations. For example:

- The walls and ceiling are surface finished and the premises are clean and free of dust
- Movement joints are dry
- Doors and windows are installed and lockable
- Cable lead-through holes are ready-installed in the floor, walls and ceiling
- The positioning of installed cable racks and busbar bridge openings and the dimensions of fire-brake openings correspond with the drawings/actual requirements.
- The switchgear mounting base meets the requirements specified in the "floor plans".

Installation sites must be equipped with:

- Sufficient lighting and heating
- A worktop for drawings and for other documents
- A lockable warehouse e.g. for tools and equipment in the immediate vicinity.

### 5.2 Manoeuvring switchgear parts onto the mounting bases

Section 4.2 (Moving and lifting) contains descriptions for the on-site transfer of packages and unpackaged switchgear parts to, e.g., the immediate vicinity of the installation site. If switchgear parts cannot be lowered directly onto their mounting base, rollers and crowbars must be used to prise them into position, see Figure 6.

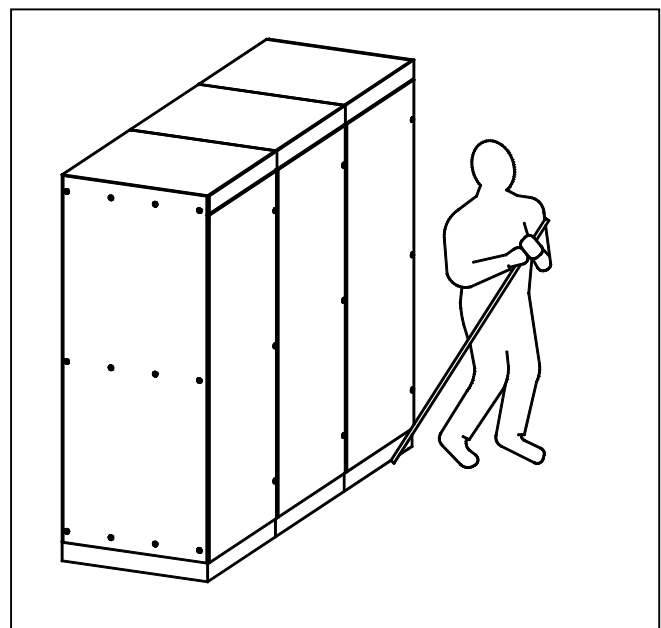


Figure 6

➡ Switchgear parts can easily topple backwards when manoeuvring on rollers or manual trolleys because their centre of gravity is typically located high up at the rear of the unit.

### 5.3 Mechanical connection of switchgear parts

Position and align the switchgear parts against each other as carefully as possible on their bases in the lengthwise and depthwise directions. Connection and fastening are performed in the following set order:

➡ Stepping on the switchgear is forbidden in places marked with



- A) Connect the PE and N busbars if necessary, see Figure 7
- B) Connect the potential equalisation conductor (if used) to the switchgear's G connector. The location of the connector is stated on the plate glued to the front of the door.
- C) Connect the main busbars, see Figure 8
- D) Connect the cooling piping, see Figure 9
- E) Connect the feeder unit to the busbar bridge or to the high-current cable system, see Chapter 8.
- F) Interconnect the switchgear parts, see Figure 10
- G) Connect the cables and multi-pole connectors between switchgear parts to their assigned addresses
- H) Connect the arc shield's sensor cables, see Chapter 8.
- I) Fix the switchgear and plinth to its base, see

#### 5.3.1 Pre-treatment of main circuit and protective earth circuit joints

**Clean the joint surfaces** of the main circuits and the protective earth circuits that are unsurfaced (i.e. without tinning or silvering) by sanding or wire brushing. Apply a thin, translucent layer of jointing grease to aluminium surfaces, even if only one half of the joint is aluminium plated. These treatments may, in some cases, be pre-applied at the factory.

The **tightening torques specified for screw connections** are valid only for the screw, nut and spring washer combination in question. Materials falling short of strength class 8.8 (screw) / 8 (nut) and corresponding torques must not be used.

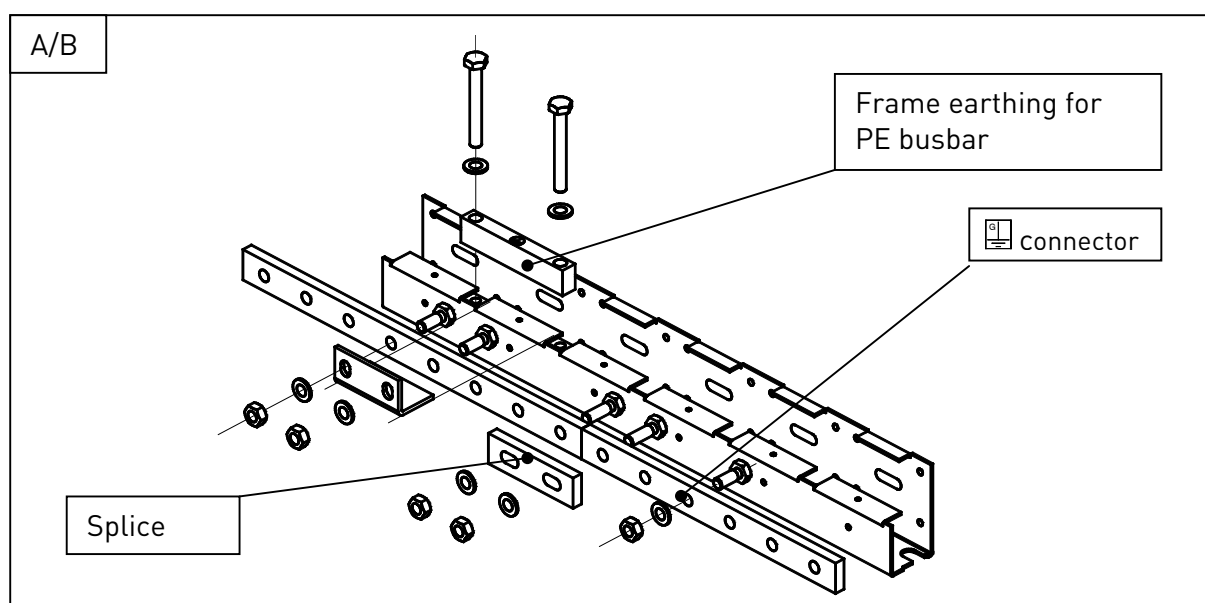


Figure 7



The PE busbar is connected to the frame at the factory in accordance with the manufacturing instructions. The busbar can also be fitted with insulators, in which case frame attachment is carried out for each transport unit. The busbar may be located either at the bottom front or bottom rear of the switchgear.

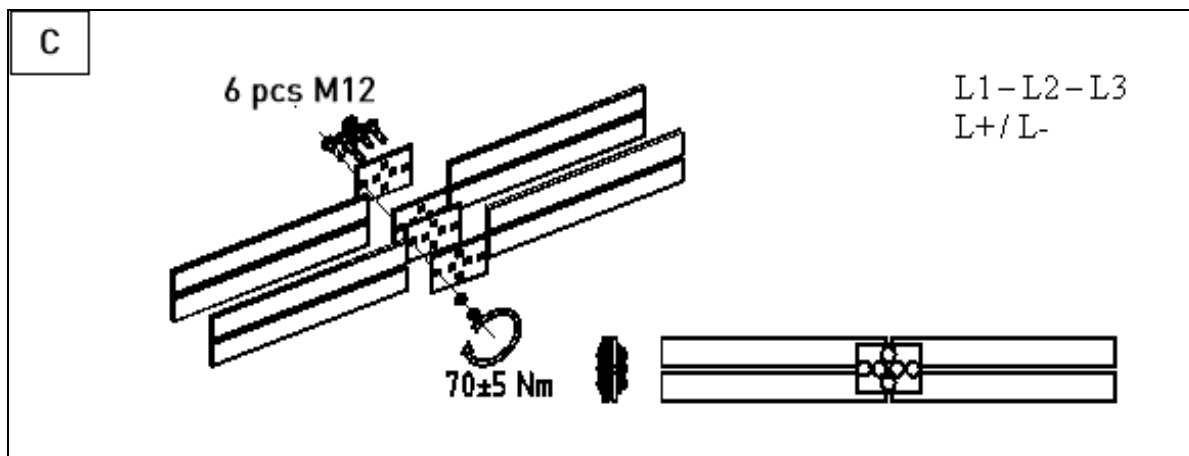


Figure 8

The main busbars are normally connected via cabling. The busbar compartment cover plate is removed and the connection plates placed on the busbars.

Busbars can also be connected via the roof, in which case a long fork spanner is needed to tighten the lowest screws, see Chapter 3.

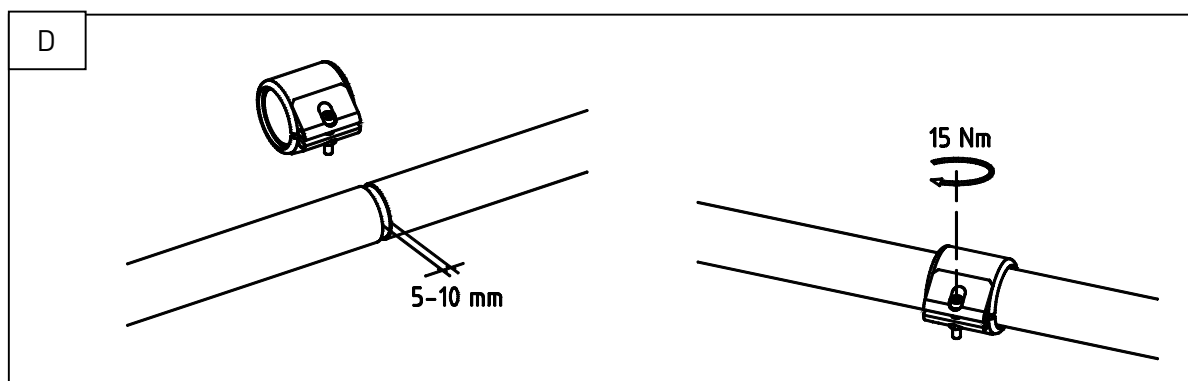


Figure 9

The liquid cooling feed and return piping are connected together for each transport unit. A linear thermal expansion clearance of approx. 5 - 10 mm must be kept between pipes.

Only the couplings illustrated in Figure 9 above (STRAUB – GRIP – L\_) may be used for pipe connections.

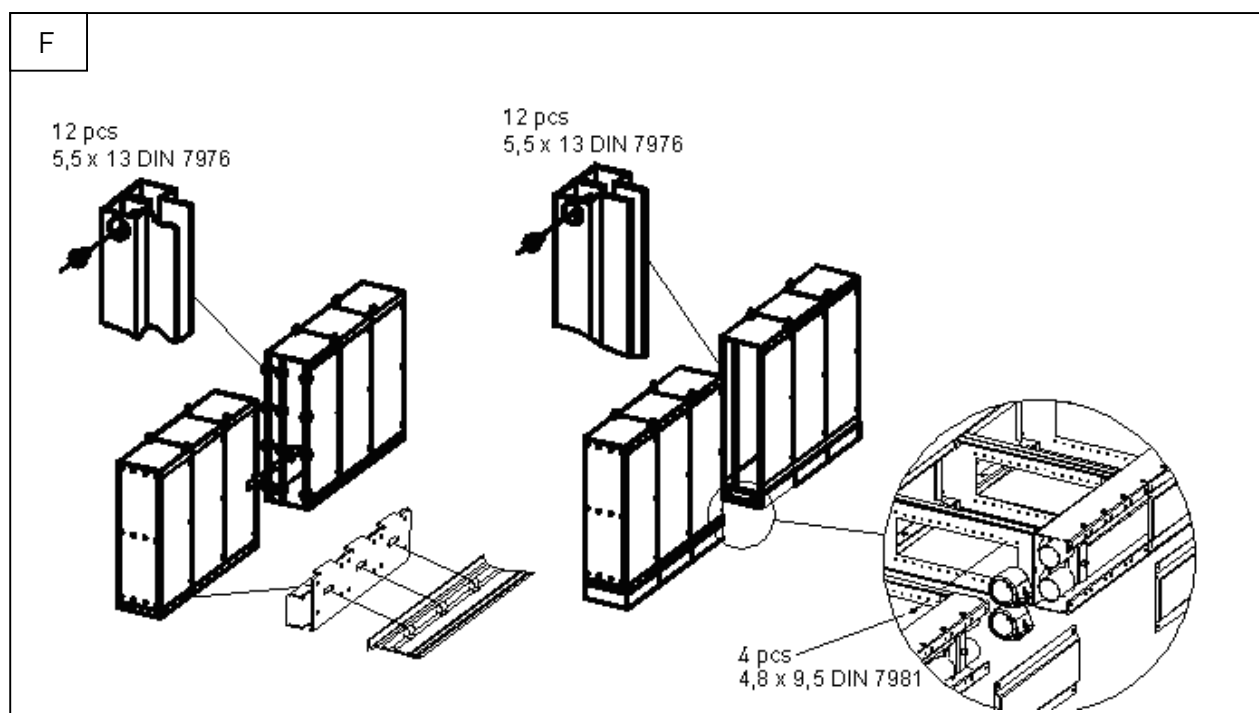


Figure 10

All necessary connection materials and instructions (instruction ref. no. Xxxxx) are included with the switchgear parts delivery. Frames are interlocked first at the rear, then in the middle and finally at the front. The plinths of the switchgear parts are fastened to each other as illustrated in Figure 10.

The plinths come ready-fastened to the switchgear parts.

The plastic base strip is fitted with spring fasteners to the switchgear mounting beam.

The lifting lugs can be removed at least from the front side.

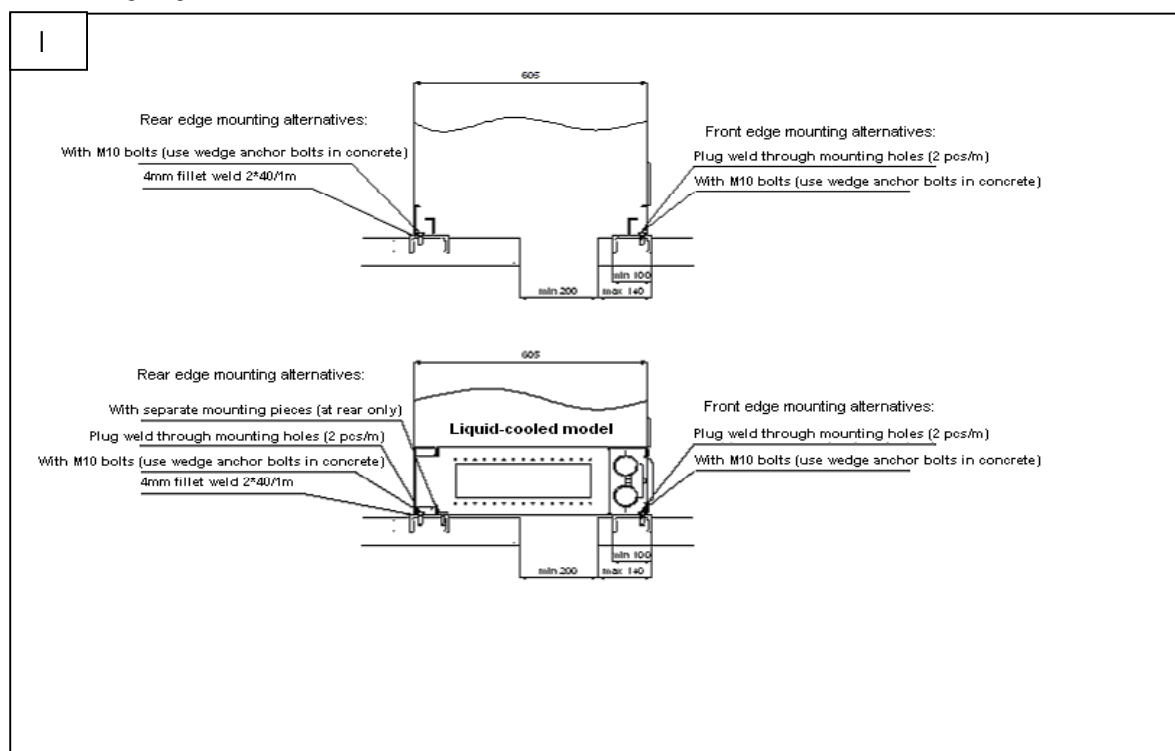


Figure 11

The switchgear is fixed to its base with wedge screws or by welding. The switchgear base consists of either concrete or steel footings, as shown in Figure 11.

➡ If possible, the circuit of the electrical welding current must be as short as possible. It is recommended to use the steel footing as the return route for welding current. The plinths of liquid-cooled switchgears are base-fastened either with mounting pieces, wedge anchor bolts or by welding. The materials for the agreed fastening method are included with the plinth delivery.

#### 5.4 Cleaning

Clean the switchgear both internally and externally before cabling (cleaning is more difficult once the unit is cabled). Check that the switchgear interior is free of foreign objects. Any damaged parts must be repaired/repair painted as necessary.

#### 5.5 Installation of ferrite cores on motor cables

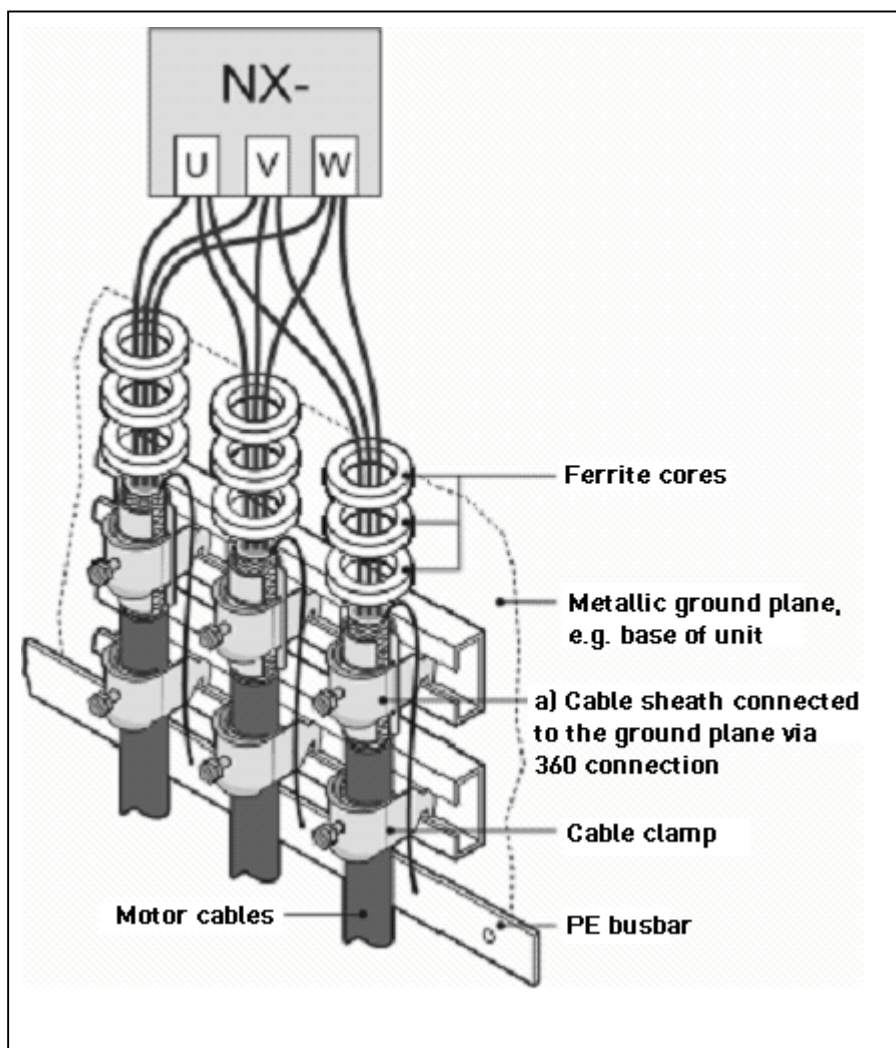


Figure 12

## 5.6 EMC grounding of motor cables

EMC grounding is carried out according to Figure 13 if the frequency converter compartment has no grounding point (liquid-cooled and large air-cooled frequency converters).

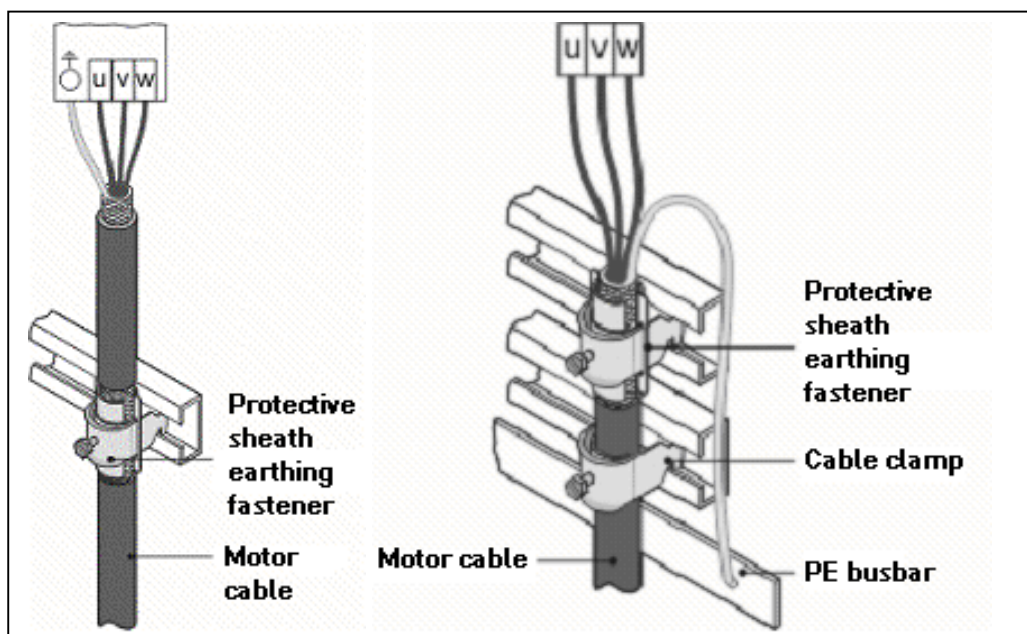


Figure 13. **Left:** NX Liquid-cooled

**Right:** NX Liquid-cooled

NX Air-cooled

$\leq 61A / 500V$

$\leq 38A / 690V$

$\geq 72A / 500V$

$\geq 45A / 690V$

$\geq 385A / 500V$

$\geq 261A / 690V$

## 6. TESTING

### 6.1 Electrical measurements

Measurement of the insulating resistance of the switchgear is carried out as a standard procedure.

**Insulating resistance** is measured in accordance with the test voltages in Table 6.1. Measurement can also be performed using a Megger or similar instrument. The test device must be able to feed 1-mA current at the measurement voltages shown in Table 6.1

Instructions are given for frequency converter cabling and motor insulation resistance measurement in the User Instructions for NX Frequency Converters in Chapter 6.1.4

Before taking the measurement:

- Disconnect the N/PE (PEN) connection (TN-C-S systems only)
- Switch on the temporary earth switch
- If the circuit contains frequency converters, only perform the measurement L1-L2-L3-(N)/frame.
- Measure the insulation resistance between all interconnected phases, including N, and the frame.

During measurement, ensure that the switches are in the off position, that there are fuses in the fuse boxes and that the switchgear is in normal operating condition but with all operational equipment (e.g. motors) disconnected.

#### Minimum acceptable insulation resistance values

L1-L2-L3-(N)/frame  
see Table 1.

Circuit $U_n$ / V	Test voltage DC / V	Insulation re- sistance M $\Omega$ 1)
Max. 500	500	$\geq 0,5$
Over 500	1000	$\geq 1,0$

Table 1.

1) The number of devices connected may lower these values slightly. If the results are substantially lower, contact the manufacturer.

### 6.2 Cooling equipment:

See Chapter 8.

### 6.3 Inspections

The following must be checked before commissioning. A record of the inspection should be drawn up, especially if the on-site installation is carried out separately.

- Splice connections of the main circuit and frame of switchgear parts (transport units) and feeder unit connections
- Connections and labelling of the protective earth and potential equalisation conductor
- Switchgear base fastenings
- Contact protection and its fastenings (after installation).
- Switchgear plates, codes and markings

- Quality of the external surfaces of the switchgear, operation of doors and cleanness of the sections.
- Enclosure class of joints of switchgear parts
- Operation of arc protection relay, if installed

## 7. COMMISSIONING

Before any other measures are taken, ensure that both the staff and the environment meet the requirements set for electrical safety at work (SFS 6002, Safety at electrical work).

Commissioning must be carried out in the following order:

- Ensure that the cooling of liquid-cooled frequency converters is functioning correctly
  - Switch on the control voltages
  - Test all control, protection and monitoring equipment
  - Test the electrical and mechanical interlock connections
  - Check that the temporary earth devices are switched on
  - Switch on the voltage to the main circuits
  - Check the functioning of the cooling equipment
  - Connect the main circuits one at a time
  - Check the accuracy of the alarm equipment and measurement equipment displays

## 8. REFERENCES

VEBA 5000 busbar bridges Installation manual.	LF 06 00: 2002
High-current cable system Installation manual.	1 kV cable systems (SLO)
Cooling equipment  Handling and filling of coolant	Vacon HXL Cooling Unit, Commissioning and Servicing Manual
Arc protection Installation manual.	VAMP 220 Arc protection system, User Manual

**Vaasa**

Vacon Oyj (Headquarters and Production)  
Runsorintie 7, 65380 Vaasa  
firstname.lastname@vacon.com  
tel. +358 (0) 201 2121  
fax: +358 (0) 201 212 205

**Helsinki**

Vacon Oyj  
Äyritie 12, 01510 Vantaa  
tel. +358 (0)201 212 600  
fax: +358 (0)201 212 699

**Tampere**

Vacon Oyj  
Vehnämyllynkatu 18, 33560 Tampere  
tel. +358 (0)201 2121  
fax: +358 (0)201 212 750

**Vacon Traction Oy**

Vehnämyllynkatu 18, 33560 Tampere  
tel. +358 (0)201 2121  
fax: +358 (0)201 212 710

**SALES COMPANIES AND REPRESENTATIVE OFFICES:****Austria**

Vacon AT Antriebssysteme GmbH  
Aumühlweg 21  
2544 Leobersdorf  
vacon.austria@vacon.com  
tel. +43 2256 651 66  
fax: +43 2256 651 66 66

**Belgium**

Vacon Benelux NV/SA  
Interleuvenlaan 62  
3001 Heverlee (Leuven)  
info@vacon.be  
tel. +32 (0)16 394 825  
fax: +32 (0)16 394 827

**France**

Vacon France  
1 Rue Jacquard - BP72  
91280 Saint Pierre du Perray CDIS  
France  
Tel : +33 (0)1 69 89 60 30  
Fax : +33 (0)1 69 89 60 40

**Germany**

Vacon GmbH  
Gladbecker Str. 425  
45329 Essen  
tel. +49 (0)201/80670-0  
fax: +49 (0)201/80670-99

**Great Britain**

Vacon Drives (UK) Ltd.  
18 Maizefield  
Hinckley Fields Industrial Estate  
Hinckley  
LE10 1YF Leicestershire  
vacon.uk@vacon.com  
tel. +44 (0)1455 611 515  
fax: +44 (0)1455 611 517

**Italy**

Vacon S.p.A.  
Via F.lli Guerra, 35  
42100 Reggio Emilia  
info@vacon.it  
tel. +39 0522 276811  
fax: +39 0522 276890

**The Netherlands**

Vacon Benelux BV  
Weide 40, 4206 CJ Gorinchem  
vacon.benelux@vacon.com  
tel. +31 (0)183 642 970  
fax: +31 (0) 183 642 971

**Norway**

Vacon AS  
Langgata 2  
3080 Holmestrand  
vacon@vacon.no  
tel. +47 330 96120  
fax: +47 330 96130

**PR China**

Vacon Suzhou Drives Co. Ltd.  
Building 13CD  
428 Xinglong Street  
Suchun Industrial Square  
Suzhou 215126  
telephone: +86 512 6283 6630  
fax: +86 512 6283 6618

Vacon Suzhou Drives Co. Ltd.  
Beijing Office  
A205, Grand Pacific Garden Mansion  
8A Guanhua Road  
Beijing 100026  
telephone: +86 10 6581 3734  
fax: +86 10 6581 3754

**Russia**

ZAO Vacon Drives  
Bolshaja Jakimanka 31  
stroenie 18  
109180 Moscow  
www.ru.vacon.com  
tel. +7 (095) 974 1541  
fax: +7 (095) 974 1554

**ZAO Vacon Drives**

2ya Sovetskaya 7, office 210A  
191036 St. Petersburg  
www.ru.vacon.com  
tel. +7 (812) 332 1114  
fax: +7 (812) 279 9053

**Singapore**

Vacon Plc  
Singapore Representative Office  
102F Pasir Panjang Road  
#02-06 Citilink Warehouse Complex  
Singapore 118530  
vacon.singapore@vacon.com  
tel. +65 6278 8533  
fax: +65 6278 1066

**Spain**

Vacon Drives Ibérica S.A.  
Miquel Servet, 2. P.I. Bufalvent  
08243 Manresa  
www.vacon.es  
info@vacon.es  
tel. +34 93 877 45 06  
fax: +34 93 877 00 09

**Sweden**

Vacon AB  
Torget 1  
172 67 Sundbyberg  
tel. +46 (0)8 293 055  
fax: +46 (0)8 290 755

**Vacon distributor:**